

1 **CLAIMS**

2 1. In a distributed file system that stores files across multiple computers,
3 a method comprising:

4 collecting changes that are made to multiple files stored in the distributed
5 file system; and

6 digitally signing the multiple changes in batch.

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8 2. A method as recited in claim 1, wherein the collecting comprises:
9 computing a hash of data in each file that is affected by the changes; and
10 grouping the hashes together in batch for signing.

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12 3. A data structure, embodied on a computer-readable medium,
13 produced by the method of claim 1.

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15 4. One or more computer readable media comprising computer-
16 executable instructions that, when executed, perform the method as recited in
17 claim 1.

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19 5. In a distributed file system that stores files across multiple computers,
20 a method comprising:

21 collecting changes that are made to multiple files stored in the distributed
22 file system; and

23 digitally signing the changed files in batch.
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1 6. A method as recited in claim 5, wherein the collecting comprises:
2 computing a hash of each changed file; and
3 grouping the hashes together for signing.
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5 7. A data structure, embodied on a computer-readable medium,
6 produced by the method of claim 5.
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8 8. One or more computer readable media comprising computer-
9 executable instructions that, when executed, perform the method as recited in
10 claim 5.
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12 9. In a distributed file system that stores encrypted files across multiple
13 computers, a method comprising:
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15 modifying one or more of the encrypted files;
16 computing a hash value of each modified encrypted file;
17 collecting the hash values into a group;
18 computing a hash value of the group; and
19 digitally signing the hash value of the group of hash values.
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21 10. A method as recited in claim 9, wherein the modified encrypted file
22 includes a metadata stream containing a header and an indexing structure, the
23 indexing structure including hashes of the files and a structure to access the hashes
24 of the files, the computing a hash value of each modified encrypted file further
25 comprising deriving a hash of the header and at least part of the structure.

1 **11.** A method as recited in claim 9, wherein the modified encrypted file
2 includes a metadata stream containing a header, per user information, and an
3 indexing tree, the indexing tree including hashes of the files, branch nodes to
4 access the hashes, and a root node, the computing a hash value of each modified
5 encrypted file further comprising hashing as a single composite the header, the per
6 user information, and the root node.

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8 **12.** A data structure, embodied on a computer-readable medium,
9 produced by the method of claim 9.

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11 **13.** One or more computer readable media comprising computer-
12 executable instructions that, when executed, perform the method as recited in
13 claim 9.

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15 **14.** One or more computer readable media comprising computer-
16 executable instructions that, when executed, direct a computing device to:
17 modify individual files stored in a serverless distributed file system;
18 compute a hash value of each modified file;
19 collect the hash values into a group; and
20 digitally signing the group of hash values.

1 **15.** One or more computer readable media as recited in claim 14,
2 wherein the modified file includes a metadata stream containing a header and an
3 indexing structure, the indexing structure including hashes of the files and a
4 structure to access the hashes of the files, the media further comprising computer-
5 executable instructions that, when executed, direct a computing device to derive a
6 hash of the header and at least part of the structure.

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8 **16.** One or more computer readable media as recited in claim 14,
9 wherein the modified file includes a metadata stream containing a header, per user
10 information, and an indexing tree, the indexing tree including hashes of the files,
11 branch nodes to access the hashes, and a root node, the media further comprising
12 computer-executable instructions that, when executed, direct a computing device
13 to hash as a single composite the header, the per user information, and the root
14 node.

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16 **17.** A data structure stored on a computer-readable medium comprising:
17 representations of modifications made to multiple files stored in a
18 distributed file system; and

19 a digital signature covering at least part of the representations to indicate
20 that the modifications were made by a user with the signature.

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22 **18.** A data structure as recited in claim 17, wherein the representations
23 comprise hashes of data in each file that is affected by the modifications.
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